

WHAT IS CLAIMED IS:

1. A demolition tool comprising:  
a universal body adapted to be attached to demolition equipment, the universal body including a guide slot extending longitudinally along the universal body;  
5 a pair of pivotable blades pivotably attached together and removably attached to the universal body;  
at least one linkage attached to each blade;  
a slide member received within the guide slot, with each linkage attached to the slide member; and  
10 a piston cylinder arrangement attached to the universal body and coupled to the slide member for moving the slide member and the blades.
2. The demolition tool according to claim 1 further including a common pivot pin connecting each linkage to the slide member.
3. The demolition tool according to claim 2 wherein the common pivot pin connecting each linkage to the slide member is aligned with a piston rod of the piston cylinder arrangement.
4. The demolition tool according to claim 1 further including a quick change assembly coupling the pair of pivotable blades to the universal body.
5. The demolition tool according to claim 4 wherein the quick change assembly includes a main pin pivotably connecting the blades and a bridge housing surrounding the main pin and detachably connected to the  
5 universal body.

6. The demolition tool according to claim 1 wherein the piston cylinder is a combined hydraulic cylinder and rotary joint.

7. The demolition tool according to claim 6 wherein the combined hydraulic cylinder and rotary joint includes a rotatable cylinder housing, a rotatable cylinder extension extending from the cylinder housing, and a stationary housing surrounding the cylinder extension.

8. The demolition tool according to claim 1 wherein each blade includes a plurality of removable inserts.

9. The demolition tool according to claim 1 further including a rotary coupling in the universal body providing for 360 degree rotation of the pair of blades.

10. A universal body assembly for a plurality of demolition tools, the universal body assembly comprising:

a bearing housing for mounting the universal body assembly to demolition equipment;

a yoke positioned forward of the bearing housing;  
a pair of sides extending from the yoke, the sides defining a guide slot extending longitudinally along the universal body assembly, the sides adapted to removably receive one of a plurality of distinct demolition tools; and

a slide member positioned within the guide slot, movable along the length of the guide slot.

11. The universal body of claim 10 wherein the sides are pivotably attached to the yoke.

12. The universal body of claim 11 wherein the pivotable sides are moved to provide access to the slide member, and further including a tie bar for coupling the pivotable sides together wherein fasteners extend through the tie bar.

13. The universal body of claim 10 wherein the sides include removable access plates which provide access to the slide member.

14. The universal body of claim 10 further including a piston cylinder assembly coupled to said slide member for moving the slide member.

15. The universal body of claim 14 further including a trunnion pivotably attaching the piston cylinder assembly to the yoke

16. The universal body of claim 15 further including a pivot pin connecting the piston rod of the piston cylinder assembly to the slide member which has an axis substantially perpendicular to the axis of the trunnion.

17. The universal body of claim 10 further including a rotary coupling between the bearing housing and the yoke.

18. The universal body of claim 17 further including a piston cylinder assembly coupled to said slide member for moving the slide member, wherein a cylinder of the piston cylinder assembly is rotatable with the yoke.

19. The universal body of claim 10 further including a quick change assembly on the sides for quickly attaching tools.

20. A multiple tool attachment system adapted to be attached to demolition equipment, the system comprising:  
a universal body attachable with the demolition equipment;

a hydraulic cylinder attached to the universal body;

a pair of linkages adapted to be coupled with the hydraulic cylinder; and

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a plurality of demolition tool units each selectively, removably attachable to the universal body and the hydraulic cylinder, each tool unit including a pair of pivotable blades adapted to be pivotally connected to the universal body and to the pair of linkages.

21. The multiple tool attachment system of claim 20 wherein at least one of the plurality of demolition tool units is a cutting shear.

22. The multiple tool attachment system of claim 21 wherein at least one of the plurality of demolition tool units is a concrete crushing tool.

23. The multiple tool attachment system of claim 22 wherein at least one of the plurality of demolition tool units is a grapple.

24. The multiple tool attachment system of claim 20 wherein at least one of the plurality of demolition tool units has each blade including a plurality of removable inserts.

25. The multiple tool attachment system of claim 20 further including a quick change assembly coupling the pair of pivotable blades of each demolition tool unit to the universal body.

26. The multiple tool attachment system of claim 25 wherein the quick change assembly includes a main pin pivotably connecting the blades of each demolition tool unit

5 and a bridge housing surrounding the main pin and detachably connected to the universal body.

27. The multiple tool attachment system of claim 26 wherein the quick change assembly further includes keeper pins adapted to be received within aligned apertures in the bridge housing and the universal body.

5 28. The multiple tool attachment system of claim 20 wherein the pair of linkages are selectively removable from the hydraulic cylinder and the universal body to accommodate further demolition tool units having distinct linkages.

5 29. The multiple tool attachment system of claim 28 wherein the pair of linkages are coupled to the hydraulic cylinder through a common pivot pin within a sleeve, wherein the sleeve can hold the linkages together after detachment from the hydraulic cylinder.

5 30. A heavy-duty shear comprising:  
a body attachable to demolition equipment;  
at least one hydraulic cylinder on said body; and  
a pair of pivotable blades attached at a common  
5 pivot point to the body and coupled to at least one cylinder for movement of the blades in a shearing relation, at least one of the movable blades includes,

10 i) a first cutting portion adjacent the pivot point of the blade,

ii) a replaceable piercing tip at a distal end of the blade, and

15 iii) a second cutting portion between the piercing tip and the first cutting portion wherein the length of the first cutting portion is less than the length of the second cutting portion.

31. The heavy duty shear of claim 30 wherein the body includes a guide slot, and further including a linkage attached to each blade, and a slide member received within the guide slot coupled to the cylinder.

32. The heavy duty shear of claim 31 further including a common pivot pin connecting each linkage to the slide member.

33. The heavy duty shear of claim 32 wherein the common pivot pin connecting each linkage to the slide member is aligned with a piston rod of the cylinder.

34. The heavy duty shear of claim 30 further including a quick change assembly coupling the pair of pivotable blades to the body.

35. The heavy duty shear of claim 34 wherein the quick change assembly includes a main pin pivotably connecting the blades at the common pivot point and a bridge housing surrounding the main pin and detachably connected to the universal body.

36. The heavy duty shear of claim 30 wherein the body includes a bearing housing for mounting the shear to demolition equipment, a yoke positioned forwardly of the bearing housing, a pair of sides extending from the yoke, the sides defining a guide slot extending longitudinally along the body, and slide member positioned within the guide slot movable along the length of the guide slot.

37. The heavy duty shear of claim 36 wherein the sides are pivotably attached to the yoke and wherein the pivotable sides are moved to provide access to the slide member.

38. The heavy duty shear of claim 36 wherein the hydraulic cylinder is coupled to the slide member for moving the slide member and further including a trunnion pivotably attaching the piston cylinder assembly to the yoke.

39. The heavy duty shear of claim 38 further including a pivot pin connecting the piston rod of the piston cylinder assembly to the slide member which has an axis substantially perpendicular to the axis of the trunnion, and a rotary coupling between the bearing housing and the yoke.

40. A demolition tool comprising:

a bearing housing attachable to demolition equipment;

a rotational coupling secured to the bearing housing;

a yoke attached to the rotational coupling and rotatable relative to the bearing housing through the rotational coupling;

side members attached to the yoke;

at least one demolition tool attachable to the side members; and

a hydraulic cylinder attached to the yoke and the bearing housing for moving the demolition tool, wherein a portion of the cylinder attached to the yoke is rotatable relative to the portion of the cylinder coupled to the bearing housing.

41. The demolition tool of claim 40 wherein the hydraulic cylinder includes a cylinder housing and a cylinder extension extending from the cylinder housing which rotate relative to the bearing housing, and a stationary housing surrounding the cylinder extension which is attached to the bearing housing.

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42. The demolition tool of claim 41 further including hydraulic lines within the cylinder housing, cylinder extension and bearing housing, wherein the cylinder housing separates the cylinder bore from the cylinder extension.

43. The demolition tool of claim 41 further including a trunnion pivotably mounting the cylinder housing to the yoke.

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44. The demolition tool of claim 43 further including a pivot pin connecting a piston rod of the hydraulic cylinder to a slide member moved by the hydraulic cylinder, wherein the pivot pin has an axis substantially perpendicular to the axis of the trunnion.

45. The demolition tool of claim 40 further including a guide member guiding the movement of a piston rod of the hydraulic cylinder.

46. The demolition tool of claim 45 wherein the guide member is a linkage pivotably attached to the side members and to a piston rod of the hydraulic cylinder.

47. The demolition tool of claim 45 wherein the guide member is a guide rod, and further including a slide member connected to a piston rod of the hydraulic cylinder and slidably received on the guide rod.

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48. The demolition tool of claim 45 wherein the guide member is a guide slot formed in the side members, and further including a slide member connected to a piston rod of the hydraulic cylinder and slidably received in the guide slot.



49. The demolition tool of claim 40 wherein the side members are separable from the yoke.

50. A method of designing and forming a demolition tool unit having a pair of moveable blades forming a jaw structure, a linkage connected to each blade, and a common hydraulic cylinder attached to each linkage for moving the blades, the method comprising the steps of:

- A) developing a general jaw geometry which defines main geometric parameters of the general jaw structure of the demolition tool unit;
- B) analyzing the jaw geometry to determine at least the working torque of general jaw structure throughout the range of motion of the blades;
- C) determining the relative value of main geometric parameters of the general jaw structure which at least optimizes the working torque characteristics throughout the range of motion of the blades; and
- D) forming a demolition tool unit having the main geometric parameters determined in step C).

51. The method of claim 50 wherein the main geometric parameters of the general jaw structure which are analyzed include a lever arm of each blade and a length of each linkage.

52. The method of claim 51 wherein the main geometric parameters of the general jaw structure which are analyzed further include a jaw depth of the blades, a maximum opening of the blades, a relative angular orientation of the

- 5 linkages to the hydraulic cylinder and a relative angular orientation of the lever arm to the hydraulic cylinder.

53. The method of claim 52 further including the step of analyzing the cycle time of the general jaw structure.

54. The method of claim 50 wherein the maximum working torque is set near the closed position of the blades.

55. The method of claim 50 wherein the working torque increases throughout the blade movement.

56. The method of claim 50 wherein the step of determining the relative value of main geometric parameters includes varying the lengths of the linkages and of the lever arms.

57. The method of claim 50 wherein the step of determining the relative value of main geometric parameters includes varying the distance between the end of each linkage and the centerline of the hydraulic cylinder.

58. A demolition tool comprising:

a universal body adapted to be attached to demolition equipment;

5 at least one movable blade pivotably attached to the universal body; and

10 one linkage extending from each movable blade to a hydraulic piston, wherein a length of each linkage is substantially equal to a length from a position where the linkage is connected to the blade to a pivot point of the blade about the universal body.

59. The demolition tool of claim 58 wherein a jaw depth of each blade is substantially equal the length of each linkage.

60. The demolition tool of claim 58 further including an offset between each the connection of each linkage to the hydraulic piston and the axis of the piston.

61. The demolition tool of claim 58 wherein each linkage is connected to the hydraulic piston at a common pivot pin.

62. The demolition tool of claim 61 wherein the common pivot pin is aligned with the axis of the piston.

63. A demolition tool adapted to be attached to demolition equipment, the tool comprising:

a universal body adapted to be attached to the demolition equipment;

a pair of pivotable blades pivotably attached to the universal body;

at least one linkage attached to each blade;

a slide member received within the body, with each linkage attached to the slide member; and

a piston cylinder arrangement attached to the universal body and coupled to the slide member for moving the slide member and the blades, wherein the force generated by the blades during movement of the blades peaks near the closing of the blades.

64. A multiple tool attachment system for selectively attaching one of a plurality of tool sets to demolition equipment, the system comprising:

a universal body having a guide slot therein;

a slide member slidably received in the guide slot;

a hydraulic cylinder attached to the universal

body and coupled to the slide member for moving the slide member along the guide slot; and

5 a quick release member for selectively attaching tool sets, wherein the quick change assembly includes a main pin pivotably connecting moveable blades of each demolition tool set and a bridge housing surrounding the main pin and detachably connected to the universal body.

65. The multiple tool attachment system of claim 64 wherein the quick change assembly further includes keeper pins adapted to be received within aligned apertures in the bridge housing and the universal body.

66. The multiple tool attachment system of claim 64 wherein the universal body includes a bearing housing for mounting the system to demolition equipment, a yoke positioned forward of the bearing housing, and a pair of sides extending from the yoke, the sides defining the guide slot extending longitudinally along the body.

67. The multiple tool attachment system of claim 66 wherein the sides are pivotably attached to the yoke, and wherein the sides are moveable to provide access to the slide member.

68. The multiple tool attachment system of claim 66 wherein the sides are removably attached to the yoke, and wherein the sides are removable to provide access to the slide member.

69. A multiple tool attachment system for selectively attaching one of a plurality of tool sets to demolition equipment, the system comprising:

5 a universal body having a pair of pivotable sides with a guide slot formed in each pivotable side;

a slide member slidably received in the guide slots in the sides; and

a hydraulic cylinder attached to the universal body and coupled to the slide member for moving the slide member along the guide slot.

70. A multiple tool attachment system for selectively attaching one of a plurality of tool sets to demolition equipment, the system comprising:

a universal body having a guide slot therein;  
a slide member slidably received in the guide slot;  
a hydraulic cylinder attached to the universal body and coupled to the slide member for moving the slide member along the guide slot; and  
a pair of linkages extending from a common point on said slide and adapted to be selectively attached to individual movable jaws of individual tool sets.

71. A tool set for coupling to a body having a hydraulic cylinder for powering the tool set, the tool set comprising:

a pair of movable blades pivoted together;  
a common pivot pin connecting the blades together;  
and  
a bridge housing coupled to the pivot pin, the bridge housing providing a quick release system for attaching the tool set to the body.

72. A heavy-duty shear comprising:

a body attachable to demolition equipment;  
at least one hydraulic cylinder on said body; and  
a pair of pivotable blades attached at a common pivot point to the body and coupled to at least one cylinder for movement of the blades in a shearing relation, one movable blade having a slot receiving the other movable blade, wherein one of the movable blades includes,

- 10 i) a first cutting portion adjacent the pivot  
point of the blade,
- ii) a replaceable piercing tip at a distal end of  
the blade, and
- 15 iii) a second cutting portion between the piercing  
tip and the first cutting portion wherein a substantially  
continuous cutting line is provided from the piercing tip to  
the end of the first cutting portion adjacent the first  
cutting portion.

73. The heavy-duty shear of claim 72 wherein the  
body includes a guide slot, and further including a linkage  
attached to each blade, and a slide member received within  
the guide slot coupled to the cylinder.

74. The heavy-duty shear of claim 72 wherein the  
first cutting portion and the second cutting portion include  
a plurality of replaceable inserts.

75. The heavy-duty shear of claim 74 wherein the  
replaceable inserts are indexable, whereby the inserts each  
include a plurality of cutting edges which can selectively be  
positioned into an operative position.